ELECTRICAL MATHEMATICS
TEST 2 – *TRIAL TEST/ASSIGNMENT*

Notes:

- This test covers substitutions, basic algebra, and evaluation of subject/transposition of formulae.
- The actual test will be closed book, calculator permitted.
- It is **ESSENTIAL** to show working/steps, where asked, otherwise **no marks** can be given.

1. Evaluate the following expressions:

   a. $a = bc$ where $b = 3.08$ and $c = 39.5$

   $a = 3.08 \times 39.5 = 121.66$

   b. $X = \frac{Y}{Z}$ where $Y = 0.00043$ and $Z = 77.9$

   $X = 0.00043 / 77.9 = 5.52 \times 10^{-6}$

   c. $R_T = R_1 + R_2 + R_3$ where $R_1 = 820$, $R_2 = 220$ and $R_3 = 470$

   $R_T = 820 + 220 + 470 = 1510$

   d. $m = (u + v)^2 s$ where $u = 40.4$, $v = 37.0$ and $s = 1.23 \times 10^{-3}$

   $m = (40.4 + 37.0)^2 \times 1.23 \times 10^{-3} = 77.4^2 \times 1.23 \times 10^{-3} =$
   $= 5.99 \times 10^{3} \times 1.23 \times 10^{-3} = 7.37$

   e. $R = (6.0 - ST)^3$ where $S = 5.7 \times 10^{-4}$ and $T = 2.87 \times 10^{3}$

   $R = (6.0 - 5.7 \times 10^{-4} \times 2.87 \times 10^{3})^3 = (6.0 - 16.359 \times 10^{-1})^3 =$
   $= (6.0 - 1.6359)^3 = 4.3641^3 = 83.12$

2. Transpose each of the following formulae, making the variable in brackets the subject of the equation.

   a. $V = IR$ (R)

   $\frac{V}{I} = \frac{IR}{I} \Rightarrow \frac{V}{I} = R \Rightarrow R = \frac{V}{I}$

   b. $I = \frac{Q}{t}$ (t)

   $It = \frac{Q}{t} \times t \Rightarrow It = Q \Rightarrow \frac{It}{I} = \frac{Q}{I} \Rightarrow t = \frac{Q}{I}$

   c. $R_T = R_1 + R_2 + R_3$ (R_2)

   $R_T - R_1 - R_3 = R_2 \Rightarrow R_2 = R_T - R_1 - R_3$

   d. $P = I^2 R$ (I)

   $\frac{P}{R} = \frac{I^2 R}{R} \Rightarrow \frac{P}{R} = I^2 \Rightarrow I^2 = \frac{P}{R} \Rightarrow \sqrt{I^2} = \sqrt{\frac{P}{R}} \Rightarrow I = \sqrt{\frac{P}{R}}$

e. $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ (R_1)

$\frac{1}{R_P} - \frac{1}{R_2} = \frac{1}{R_1}$

$\frac{1}{R_1} = \frac{1}{R_P} - \frac{1}{R_2}$

$\frac{1}{R_1} = \frac{R_2}{R_P R_2} - \frac{R_P}{R_P R_2}$

$\frac{1}{R_1} = \frac{R_2 - R_P}{R_P R_2}$

$R_1 = \frac{R_P R_2}{R_2 - R_P}$

3. Express the following in their simplest form:

a. $4m^2 - 7mn + 3m^2 - 2mn + 5 = 7m^2 - 9mn + 5$

b. $(a - b) - (a + b)$

$a - b - a - b = -2b$

c. $(a - b)(a + b)$

$a^2 + ab - ab - b^2 = a^2 - b^2$

d. $(3x - 4y)(3x - 4y) + 24xy$

$9x^2 - 12xy - 12xy + 16y^2 + 24xy = 9x^2 + 16y^2$

e. $24xyz \div 12y$

$\frac{24xyz}{12y} = 2xz$

4. Solve the following equations for the unknown:

a. $5 - \frac{x-3}{2} = 0$

$\frac{5 \times 2}{2} - \frac{x-3}{2} = \frac{0 \times 2}{2}$

$10 - (x-3) = 0$

$10 - x + 3 = 0$

$10 + 3 = x$

$x = 13$

b. $\frac{3}{m} + \frac{2}{m} = \frac{15}{6}$

$\frac{(3+2)}{m} = \frac{15}{6}$

$\frac{5}{m} = \frac{15}{6}$

$m = \frac{5 \times 6}{15} = \frac{6}{3} = 2$

c. $\frac{4}{5y + 2} = \frac{7}{7y - 3}$

$(5y+2) \times 7 = 4 \times (7y-3)$

$35y + 14 = 28y - 12$

$35y - 28y = -12 - 14$

$7y = -26$

$y = -\frac{26}{7} = -3\frac{5}{7}$

5. Given $I = \dfrac{I_1(R_1 + R_2)}{R_2}$

a. Evaluate I when $I_1 = 240\text{mA}$, $R_1 = 680\Omega$ and $R_2 = 2.2\text{k}\Omega$

$$I = \frac{240\times10^{-3}\,(680+2200)}{2200} = \frac{240\times10^{-3}\times 2.88\times10^{3}}{2200} =$$

$$= \frac{691.2}{2200} = 314\times10^{-3}\,\text{A} = 314\,\text{mA}$$

b. Transpose to find R_2

$$I R_2 = I_1(R_1 + R_2)$$
$$I R_2 = I_1 R_1 + I_1 R_2$$
$$I R_2 - I_1 R_2 = I_1 R_1$$
$$(I - I_1) R_2 = I_1 R_1$$
$$R_2 = \frac{I_1 R_1}{I - I_1}$$

c. Evaluate R_2 when $I = 1.07\text{ A}$, $I_1 = 970\text{mA}$ and $R_1 = 82\text{k}\Omega$

$$R_2 = \frac{970\times10^{-3}\times 82\times10^{3}}{1.07 - 0.97} = \frac{79\,540}{0.1} = 795.4\,\text{k}\Omega$$

6. Solve for x in each of the following:

a. $2v = 3u + ax$

$$2V - 3u = ax$$
$$ax = 2V - 3u$$
$$x = \frac{2V - 3u}{a}$$

b. $\frac{k}{x^2} = 5w + 2$

$x^2(5w+2) = k$

$x^2 = \frac{k}{5w+2}$

$x = \pm\sqrt{\frac{k}{5w+2}}$

c. $y = n - \sqrt{\frac{x-a}{3}}$

$\sqrt{\frac{x-a}{3}} = n - y$

$\left(\sqrt{\frac{x-a}{3}}\right)^2 = (n-y)^2$

$\frac{x-a}{3} = (n-y)^2$

$x - a = 3(n-y)^2$

$x = 3(n-y)^2 + a$

------- **END OF TRIAL TEST/ASSIGNMENT - *Check your work!*** -------